The upgrade to hybrid incubators in China: a case study of Tuspark incubator

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Abstract

Purpose – This study aims to explore key factors and specific ways for the upgrade to hybrid incubators in the context of China. A hybrid incubator means that a technology-based business incubators (TBIs) can implement various distinct value creation processes with the integration of the advantages of non-for-profit and for-profit TBIs at same time as Chinese government now requires government-sponsored non-for-profit TBIs to be profitable self-sustainability with less dependent on direct public subsidies, aiming to motivate these TBIs to provide higher quality services for their tenant new technology-based firms (NTBFs).

Design/methodology/approach – This study conducts a single in-depth case-study of Tuspark Incubator (located in Tsinghua Science Park [TSP]) with categorical analysis.

Findings – Three factors, i.e. incubation subdivision, intermediary platform and proactive approach, are found to be essential for a formerly government-sponsored TBI's upgrading. Incubation subdivision enables Tuspark Incubator to create multiple incubation processes with incubator characteristic variables of both non-for-profit and for-profit incubators; with the establishment of intermediary platform, Tuspark Incubator provides specialized business support and high-quality networking from relevant specialized service organizations external to the incubator; more proactive approach with equity investment on incubating firms from Tuspark Incubator help to generate social welfare and financial profit at the same time.

Practical implications – For the incubators' managers, incubation subdivision enables TBIs to operate for-profit and non-for-profit processes at the same time and provides different specific needs; more open intermediary service platforms can leverage the full potential of the actors in innovation system and help TBIs to save resource when upgrading to hybrid incubators; proactive approaches nurture learning climate and entrepreneurship environment to enhance the successful rate on NTBFs inside incubators and provide main profit source for incubators. For policy makers, using proactive approaches including creating a good milieu for incubation on technology-based start-ups and the design of public guidance funds is increasingly crucial.

Originality/value – This research is a pioneering study on the key factors and specific ways for the upgrade of government-sponsored non-for-profit TBIs in China to hybrid for-profit and non-for-profit incubators.

Keywords China, Categorical analysis, Hybrid incubator, Incubator

Paper type Research paper

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1. Introduction

Technology-based business incubator (TBI), which is an overall denomination for organizations that constitute or create a supportive environment to foster new technology-based firms (NTBFs), has become ubiquitous worldwide (Bergek and Norrman, 2008; Chan and Lau, 2005). As a fast developing economy, the central government of China emphasizes the importance of TBIs for nurturing NTBFs to support the indigenous innovation strategy (Armanios *et al.*, 2016; Huang *et al.*, 2013; Hussler *et al.*, 2010; Sutherland, 2005). From the 1980s, TBIs have become a crucial "science and technology initiative to promote technology transfer and diffusion" in China (Hu, 2007, p. 77). By the end of 2012, there are 1,239 TBIs in China providing services to incubating a wide range of firms (Su *et al.*, 2015).

Being embedded in an emerging economy with strong public intervention, TBIs in China are predominantly state-owned or government-sponsored with strong administrative features of public institutions or state-owned enterprises (Chandra and Fealey, 2009; Harwit, 2002). However, the incubating efficiency of these government-sponsored non-for-profit TBIs is low, as they are heavily dependent on governmental subsidies, simply satisfy political demand from government and lack of specialized capabilities (Barbero *et al.*, 2012; Chandra and Fealey, 2009; Harwit, 2002; Lalkaka, 2002). Having realized these problems, Chinese government have begun to reduce subsidies since 2011[1]. Chinese government also requires non-for-profit TBIs to be profitable and self-sustaining[2]. This reform may push TBIs to provide higher quality services to better serve existing tenant firms and to attract more start-ups. While TBIs with for-profit objectives may focus more on short-term gains and avoid long-term and risky investment on scientific and technological innovations, thus, it may deviate from the indigenous innovation strategy and are at a risk of diluting the original not-for-profit objectives of public sectors (Von Zedtwitz and Grimaldi, 2006).

To cope with the aforementioned dilemma, scholars attempted to integrate the advantages of non-for-profit and for-profit features of TBIs (Aaboen, 2009; Becker and Gassmann, 2006). Informed by the concept of hybrid organization which refers to an organization that combines two or several distinct institutional logics or value creation processes (Aaboen, 2009; Battilana and Dorado, 2010; Battilana and Lee, 2014; Besharov and Smith, 2014; Bhabra-Remedios and Cornelius, 2003), we propose a concept called hybrid incubator in this study and aims to explore its rationale and upgrade. We define hybrid incubator as an incubator with features of both non-for-profit and for-profit incubators. In other words, hybrid incubators can gain profits through more efficient incubation activities while remain public functions to support indigenous innovation. However, few studies explore how a non-for-profit incubator can upgrade to a hybrid incubator under the emerging economy context. Discussions about the upgrading paths and key factors influencing on the integration of non-for-profit and for-profit features remain scant.

This study attempts to explore how non-for-profit TBI can upgrade to "hybrid incubator" in China. Factors and paths which enable government-sponsored TBIs upgrade to hybrid incubators will be identified. To our knowledge, it is the first study related to this type of hybrid incubators in China. By using a single in-depth case-study of Tuspark Incubator (located in TSP) and categorical analysis, we find that three factors, namely, incubation subdivision, intermediary platform and proactive approach, are essential for upgrading of a former government-sponsored TBI.

2. Literature review

TBIs are now playing a key role as the intermediary and accelerator for technology transfer in innovation systems (Armanios *et al.*, 2016; Bergek and Norrman, 2008). Among NTBFs, incubating enterprises are more successful than non-incubating enterprises in terms of sales,

survival, innovation, technology adoption and commercialization efficiency, etc. (Aerts *et al.*, 2007).

In emerging economies, capital markets and legal systems are usually imperfect, and innovation activities often rely on public resources (Eesley, 2016; Hoskisson *et al.*, 2000). Thus, public-backed TBIs mainly sponsored by governmental subsidies are important for NTBFs to access public support (Colombo and Delmastro, 2002; Lalkaka, 2002). Non-for-profit TBIs are usually generic incubators for social welfare improvement such as job creation (Barbero *et al.*, 2012; Monkman, 2010). However, these non-for-profit TBIs are not fully exposed to market competition and lack of incubating capabilities due to the lack of market orientation (Chandra and Fealey, 2009; Harwit, 2002). With little motivation on profit generation, non-for-profit TBIs are simply inclined to follow the science and technology policy and are less proactive in providing appropriate services to satisfy the demand of their incubating firms (Grimaldi and Grandi, 2005). These might result in high failure rate of incubating NTBFs and waste of invested public fund on non-for-profit TBIs.

Private-owned for-profit TBIs are regarded to overcome the shortages of those non-for-profit ones due to their market orientation nature (Grimaldi and Grandi, 2005). For-profit TBIs are usually specialized incubators to foster promising NTBFs in certain specific fields (Grimaldi and Grandi, 2005). To gain profit from successful incubation of NTBFs, for-profit TBIs should provide more targeted and high value added resource support and services to tenant firms (Grimaldi and Grandi, 2005; Lalkaka, 2003). This will help non-for-profit TBIs to wean themselves from government support and to upgrade toward profitable self-sustainability (Chandra and Chao, 2011; Chandra and Fealey, 2009). However, for-profit TBIs are usually short-term oriented and wants to gain rapid financial return and thus are more willing to incubate NTBFs focusing on less risky technological development and with comparatively lower failure rate (Etzkowitz, 2003; Von Zedtwitz and Grimaldi, 2006).

To cope with the dilemma, a type of incubator that integrates non-profit and profit mechanisms with high-tech focus is introduced in China (Chandra and Chao, 2011). Such incubator incubates high-tech firms, provides basic and higher value-added services and gets fast financial return as well as grants long-term support at the same time to satisfy both governments and incubating enterprises. We term this type of incubator as a hybrid incubator (Bhabra-Remedios and Cornelius, 2003). The proposition of "hybrid incubators" stems from hybrid organization which integrates multiple institutional logics and distinct value creation processes (Aaboen, 2009; Battilana and Dorado, 2010; Battilana and Lee, 2014; Besharov and Smith, 2014).

Although hybrid incubators have gained increasing practices in China, several unsolved but major theoretical issues persist in relation to the upgrading of non-for-profit incubators. The first core issue is about how non-for-profit TBIs begin to make profit. More specifically, by which ways non-for-profit incubators can change their main profit sources from public support to financial returns from market. The second core issue is about how two distinct value creation logics and processes co-exist within hybrid incubators, as tensions between the two distinct logics may deteriorate or even collapse an incubator (Battilana and Dorado, 2010). The third core issue is about how hybrid incubators allocate resources, for example, how non-for-profit incubators allocate resources to add functions of for-profit incubators while retaining non-for-profit functions for social welfare improvement at the same time.

3. Research method

Due to little research focusing on the upgrading of incubators and the uniqueness of Chinese context, a single, in-depth, exploratory case study is therefore conducted, which is the most appropriate for studying a under developed theoretical area and a poorly understood

phenomena (Chan and Lau, 2005; Hsu *et al.*, 2003; Marshall and Rossman, 2011). As Yin (2013) points out, a case-study can provide rich empirical evidences for a particular phenomenon by exploiting a variety of data sources. Moreover, this case is also revelatory in nature, and according to Yin (2013), a single revelatory case study enables an investigator to understand and analyze a phenomenon previously inaccessible to scientific investigation with a greater depth of observation than multiple case studies (Schwartz and Hornych, 2008; Yin, 2013).

3.1 Case selection

Tuspark Incubator is selected as the study objective. Tuspark Incubator, as one of the state-level technology-based incubators owned by a public institution and initially sponsored by public funds, has a number of "rare or unique" features to be an ideal "theoretical sampling" candidate (Eisenhardt, 1989) and a "revelatory case" (Yin, 2013).

Tuspark Incubator is located at Tsinghua Science Park (TSP) which was established in 1993. At the beginning, Tuspark worked as an incubation department and mainly relied on public subsidies. After six year of incubation experiences, Tuspark Incubator was formally established. In 2001, the management company of Tuspark Incubator was established and from then on Tuspark Incubator has grown rapidly to be one of the most successful TBIs in China (Zou and Zhao, 2014). Since the twenty-first century, Tuspark has expanded its activities in various ways such as equity investment, entrepreneurship training and network building to be self-profitable. With comparatively long development history and experiences (Table I), Tuspark can provide sufficient data to support the study.

Third, Tuspark as an incubator is hybrid in nature, which is in line with the research question. On the one hand, Tuspark has obtained great social returns since its establishment. With the accumulated investment of RMB 39.12m on public service platform, Tuspark Incubator has nurtured 196 graduated technology-based firms from its founding up until 2012 according to the latest China Torch Statistical Yearbook[3]. In 2012, Tuspark Incubator had 90 incubating firms with 2371 employees, 247 approved intellectual properties and 77 invention patents. Simultaneously, Tuspark Incubator also shouldered ten national science and technology projects in 2012 as well. Recently Tuspark Incubator established two specialized incubators, technology, media, telecom (TMT) and

Table I. Context and chronology of events in Tuspark incubator's development[a]

1993	Establishment of Tsinghua Science Park
1999	Formal establishment of Tuspark Incubator
2001	Establishment of TusPark Technology Business Incubator Ltd. which is the management company of Tuspark Incubator, creating the development mode of "incubation + venture capital" and confirming development direction of specialized incubation
2002	Establishment of specialized bio-tech incubator in Tuspark Incubator
2004	Establishment of the public testing platform in Tuspark Incubator
2005	Co-establishment of the service platform for high-tech innovation enterprises with Haidian government
2006	Launched "Diamond Project" in Tuspark Incubator
2010	Two invested firms, Highlander (300065) and Sumavision (300079), are listed on the Shenzhen Stock Exchange
2011	Establishment of specialized TMT incubator in Tuspark Incubator Launched Angel investment platform
2013	Establishment of specialized nanotechnology incubator in Tuspark Incubator

Note: [a]Created based on the exclusive data from Tuspark Incubator (in Chinese)

nanotechnology, in 2011 and 2013, respectively, to support the transfer of technology achievement with high failure rate and long incubation term in developing countries, especially nanotechnology (Romig *et al.*, 2007) to satisfy policy demands (Guan and Ma, 2007; Shapira and Wang, 2009).

While Tuspark Incubator is playing a key role on achieving social functions, it is also one of the most profitable TBIs in China although it has the public-sponsored background. Tuspark Incubator was one of the earliest adopting innovation and entrepreneurship funds[4]. As shown in Table I, Tuspark Incubator confirmed the profitable development mode "incubation + venture capital" in 2001. In 2010, two graduated firms with equity investment were listed on the Shenzhen Stock Exchange, and this gave Tuspark Incubator a huge amount of financial returns. From 2007 to 2013, eight firms with equity investment from Tuspark Incubator successfully came into the stock market. In 2011, Tuspark Incubator built an Angel investment platform for further investment on its tenant firms.

3.2 Data collection

To collect primary data on Tuspark Incubator, 11 face-to-face semi-structured in-depth interviews (Table II) were conducted over a period of six months (June-December 2013). The interviews were done in three batches, and interview outline is designed according to the research problem; yet was slightly adjusted for interviewees at different positions. The first round of interviews was done in June with the management team and experts to profile the overall picture of Tuspark Incubator. The second interview round was with employees of Tuspark Incubator to depict the specific features and daily operations of this incubator. Based on the second batch of interviews, the third batch of interviews were carried out with members from some other agents related to Tuspark Incubator, such as venture capital and public guidance funds management organization, aiming to gain further understanding of Tuspark Incubator. Meanwhile, data collected from the second and third rounds of interviews complement to each other. Most interviews last around 1 to 2 h in Chinese, among which six were recorded, and the rest were taken notes. Recorded interviews were transcribed and translated in English. All interviews added up to around 17 h, and reflective notes were written after each interview. Moreover, the first author of this study was engaged in the daily operation of Tuspark incubator and therefore gained rich primary data from participatory observations.

Interviewee's no.	Position	Date of interview
1	Chairman of Tsinghua Science Park	2013.6
2	Associate Professor from Tsinghua University	2013.6
3	Director of Tuspark Incubator	2013.11
4	Manager of Tuspark Incubator	2013.11
5	Investment Specialist of Tuspark Incubator	2013.11
6	Customer Service Specialist of Tuspark Incubator	2013.11
7	Former Director of Tuspark Incubator	2013.12
8	Senior Advisor of Tuspark Ventures	2013.12
9	Senior Researcher of Tuspark Research Institution for Innovation	2013.10
10	Researcher of Tuspark Research Institution for Innovation	2013.12
11	Deputy General Manager of Beijing Zhongguancun Venture Capital Development Co., Ltd.	2013.11

Table II. Interview respondents

To ensure data triangulation (Yin, 2013), secondary data about Tuspark Incubator were also collected via various ways such as websites, own business reports and manuals, released academic literatures for relevant research and newsletters etc.

3.3 Data analysis

Due to the exploratory nature of the study, technique of categorical analysis is adopted inductively in the data analysis stage, to find the key factors during the upgrade of Tuspark Incubator to ensure its success based on previous studies (Anand *et al.*, 2007; Gioia and Thomas, 1996). After screening context about upgrade of Tuspark Incubator from the case study interviews, 232 codified statements consisting of a sentence or a sequence of sentences conveying a coherent point about how Tuspark Incubator upgrades from non-for-profit TBIs to hybrid incubator were yielded. Then we identified several first-order terms and concepts during the initial readings of the codified statements (Gioia and Thomas, 1996). An example is the often-used "self-owned innovation and entrepreneurship funds" to describe how they support the financial vulnerable start-ups and simultaneously gain returns from investment on them. For each case, we compared data across informants to identify key concepts and the relationships among them and classify them under refining categories for identifying second-order dimensions (e.g. "internal investment funds"). These second-order themes enable us to capture higher level abstraction (Gioia and Thomas, 1996). At last, we aggregated second-order dimensions into several key factors (e.g. "proactive approach") that construct the main body of the study (Gioia and Thomas, 1996).

4. Key findings

According to our data analysis, three key factors impact on the upgrade of Tuspark is identified and will be elaborated below, i.e. incubation subdivision, intermediary platform and proactive approach.

4.1 Incubation subdivision

According to the study of Aaboen (2009), incubator can have different value creation processes to both gain profit and satisfy government requirements. A clear definition of customers is the basis of the dual value creation processes, as a successful incubator needs to match their operations and activities to satisfy demands of target customers (Von Zedtwitz and Grimaldi, 2006). Tuspark Incubator utilizes incubation subdivision to classify its incubating firms by different criteria and provides them with customized resources and services to match different demands (Figure 1). Incubation subdivision are considered during the interview with 120 (52 per cent) codified statements. Three second-order dimensions are included in this factor.

4.1.1 Classification by industrial sectors. First is the classification by industrial sectors. According to the interview, at the initial stage of Tuspark Incubator, no specific industrial focus was set, and incubating firms were only selected from infant technology-based spin-offs[5] from Tsinghua University. As a manager described:

> At the first decade, target customers of our incubator were very clear, we select high-tech start-ups with a variety of origins with Tsinghua University and help them to transfer the basic research achievements into commercialized products (Interviewee 4).

This is consistent with Grimaldi and Grandi's research result (2005) on the selection criterion of non-profit university-based incubator. This type of incubator often nurture start-ups whose ideas are from parent universities with generic industrial sectors (Grimaldi and Grandi, 2005). With the development of the incubator, Tuspark Incubator not only focuses

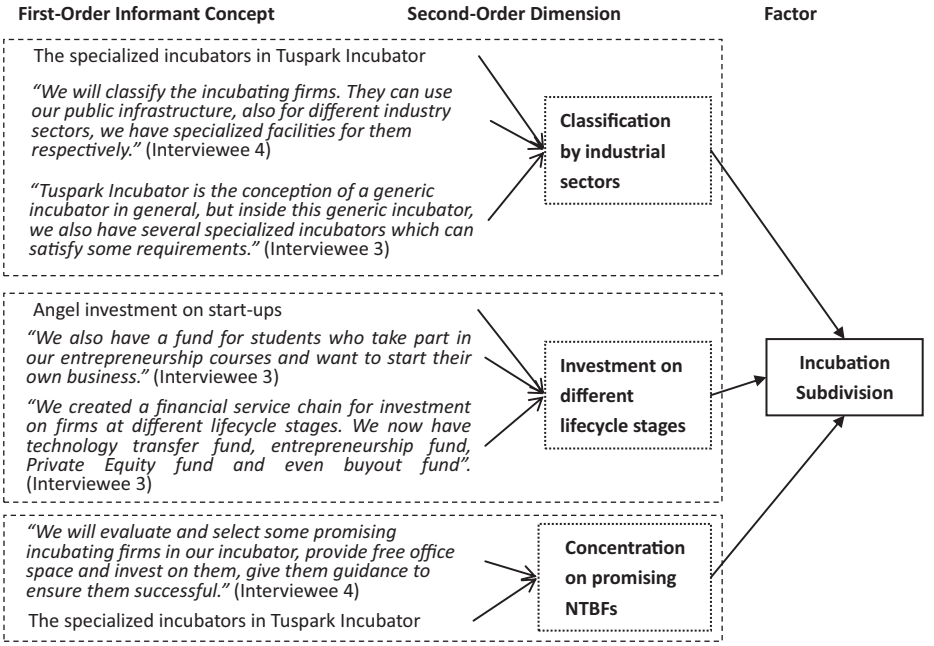

Figure 1.
Categorical analysis for upgrade factors: Incubation subdivision

on university spin-offs as its potential incubating enterprises but also expands its incubating enterprise segments gradually. High-tech start-ups which are not Tsinghua University spin-offs but possessing matured technology with commercial potential can also be selected. Incubating firms normally come from different industrial sectors such as ICT, environment, energy, materials and electronics, etc. to cope with the national strategy, facilitate job creation and technological development, technology and social welfare and economic development.

Based on a generic incubator, Tuspark Incubator began to further subdivide its tenant firms into different industrial sectors for building several specialized incubators inside itself. And the firms' selection in this kind of specialized incubator only focuses on a specific industrial sector. The first specialized incubator established in Tuspark Incubator in 2002 was in bio-tech field. From 2011, two other specialized incubators focusing on nanotechnology and TMT were established, respectively, within Tuspark Incubator. Tuspark Incubator uses "small incubators in one large incubator" (Interviewee 4) to describe the structure based on its incubation subdivision. As a manager of Tuspark Incubator mentioned:

> We will classify the incubating firms. They can use our public infrastructure, also for different industry sectors, we have specialized facilities for them respectively (Interviewee 4).

One advantage of this incubation subdivision is that it enables the identification of different needs of various sub-incubators. High-tech industrial sectors usually depend on highly sophisticated technologies and equipment. Thus, firms in such industries require more targeted and efficient incubation services. By incubation subdivision, Tuspark Incubator can provide more accurate specialized resources to target industrial sectors which are investigated to be a way of incubation with high efficiency (Schwartz and Hornych, 2008).

Another advantage is that Tuspark Incubator can satisfy government demands by incubation subdivision as well as gaining financial rewards from investment on incubating firms. Apart from the aforementioned social welfare generated by the generic incubator, the specialized incubator of Tuspark Incubator can facilitate the development of those national and regional strategic industries. The strategic industries defined by government are usually in advanced technology filed with longer incubation period and higher failure rates. Nanotechnology is a typical example:

> There are few incubators in Beijing which are willing to nurture nanotech start-ups, resulting in that firms based on nanotechnology left Beijing to Jiangsu Province where the local governments established specialized nanotech incubators. But you know most of the nanotechnology research achievements are gained from research institutions in Beijing. So Beijing government wants someone to establish incubators for this field, and Tuspark Incubator help Beijing government to achieve this social objective (Interviewee 5).

Although the failure rate of incubating firms in the abovementioned field is considerably high, negative impacts on the profitability and self-sustainability of Tuspark Incubator is limited. This is because the incubator has several independent incubation processes running in parallel Tuspark Incubator can adjust the percentage of investment on various specialized incubators to ensure its profitability at the overall level. In other words, Tuspark Incubator focuses on short-term support and gains high financial returns through the firms in some specific industrial sectors which can accomplish technology transfer more quickly and easily. On the other hand, Tuspark Incubator provides long-term support to the strategic industries which cannot gain fast return in a short term. As a manger described:

> Firms such as in IT industry may be incubated very fast in 1 to 2 years, even 1 year they can graduate from our incubator. We can then gain the fast returns of them. While some industry like nanotechnology, the incubation period could be quite long for several years, so in these incubators we set longer incubation period (Interviewee 4).

Based on classifying incubating firms from different industrial sectors, Tuspark Incubator accomplishes Becker and Gassmann' opinion (2006) that non-for-profit TBIs can achieve the goals of gaining fast financial returns and at the same time nurturing long-term technology transfer to satisfy governments' social objectives. It also successfully creates different incubation processes to meet the demands of customers, NTBFs and governments (Aaboen, 2009). In addition, this model support Tuspark Incubator's upgrade to hybrid functions with for-profit and non-for-profit.

4.1.2 Investment on different lifecycle stages. Second is financial investment on different lifecycle stages. Infant companies, especially NTBFs are exposed to financial difficulties such as initial undercapitalization (Colombo and Grilli, 2007; Roberts, 1991). Moreover, according to research on NTBFs of the UK (Westhead and Storey, 1997), start-ups with more technological sophistication had more financial obsessions. Financial vulnerability also impedes the development of NTBFs' innovation capabilities. Research on NTBFs in Tuspark shows that due to the lack of financial support, start-ups struggle to change their products rapidly to survive in the fierce market competition. Little is deployed to R&D activities to improve their innovation capabilities (Motohashi, 2013). Traditional public-sponsored non-for-profit TBIs heavily depend on direct subsidies from public sectors (Grimaldi and Grandi, 2005); however, such direct public subsidies are scant to support NTBFs for survival. For example, Tuspark Incubator found that the direct public subsidies have extremely complex administrative examination and approval procedures with long time which failed to satisfy the demand of incubating technology-based infant firms. Thus, other financial resources besides public subsidies are considered to be increasingly

important for nurturing NTBFs by overcoming capital market barriers, e.g. venture capital is often considered as one of major sources of equity financing for NTBFs (Park *et al.*, 2002). Econometric results also strongly support the view that venture capital investments positively influence the growth of NTBFs (Bertoni *et al.*, 2011). Accordingly, Tuspark Incubator began to help its incubating NTBFs accessing to external venture capitalists since 2001 to overcome the information asymmetry between NTBFs and venture capitalists which is the main barrier of new ventures for receiving venture capital.

However, Tuspark Incubator found that external venture capital was insufficient for its incubating NTBFs and decided to launch its own entrepreneurship and innovation funds. According to the interviews, three reasons for creating self-owned funds are mentioned re regarded to be the motivation for creating self-owned funds. The first two reasons are related to the specific situations in China. One is challenges from the institutional context of China, and the other is inexperience of Chinese venture capitalists due to its short history in China (Ahlstrom *et al.*, 2007). The third reason is that profit-driven venture capital prefers to invest at the later stage of the development lifecycle based on the "stage model" (Roberts, 1991). And at initial stage of NTBFs, other sources of funds, such as entrepreneurship funds, seed funds and angel investments may be more important for nurturing new ventures (Roberts, 1991). Tuspark Incubator therefore granted angel investment at small amounts normally ranging from RMB 1 to 1.5m for each case. Such Angel funds are provided for resource vulnerable start-ups initial development and enable them to gain quick development and survival. An informant described:

> [. . .] so our incubator can give the angel investment directly. We have the annual investment. [. . .] as an investment specialist, my invest right is a maximum of 1.5 million RMB for each (Interviewee 5).

The specific financial needs of NTBFs on different lifecycle stages are distinct (McAdam and McAdam, 2008). With the growth of the incubating NTBFs, it is difficult for angel investment to fulfill the financial gaps of these firms. Thus, Tuspark Incubator has gradually expanded its investment by creating various funds from technology transfer funds to buyout funds covering the whole lifecycle stages of incubating firms to satisfy the specific financial requirements of these start-ups:

> We created a financial service chain for investment on firms at different lifecycle stages. We now have technology transfer fund, entrepreneurship fund, Private Equity fund and even buyout fund (Interviewee 3).

With the support of the financial resource provided by Tuspark Incubator, the survival rate of tenant NTBFs is increased. While better facilitating the growth of NTBFs, the incubator can gain profit back from the investment simultaneously. According to previous studies, for-profit BTIs achieve positive gains through service fees and equity stakes in new ventures in the medium to long-term (Becker and Gassmann, 2006; Grimaldi and Grandi, 2005). As the interviewees described, service fees are not the main profit sources of Tuspark Incubator because the internal services of the incubator are entirely free for the incubating firms which can be regarded as a kind of social welfare that Tuspark Incubator creates. Thus, the largest revenue stream of Tuspark Incubator is the financial returns of investment on the incubating firms:

> [. . .] we can make a lot of profit from investment, this is the main profit resource to us. For example, we have gained approximately 68 million RMB by investing about 15 million RMB as equity investment on our incubating firms in recent years (Interviewee 5).

TSP also gives Tuspark Incubator the autonomy and decision-making rights to allocate the investment profits. This obviously enhanced the motivation of the management team for investment and improved the efficiency for fostering the NTBFs. Apart from support of wealth creation of NTBFs, Tuspark Incubator also underpins the technology transfer and entrepreneurship climate cultivation of Tsinghua University by using several special funds. These funds are usually angle funds for student entrepreneurs from Tsinghua University to start their own business:

> We still have a fund for students who take part in our entrepreneurship courses and want to start their own business, this fund has 20 million RMB yearly, we will select 10 promising projects giving 2 million RMB each (Interviewee 3).

In addition, Tuspark Incubator accomplishes the social objectives of the local government by involving public guidance funds in its funds. Referring to the Israel national innovation system practices, national-level and local-level Chinese governments established public guidance funds. Public guidance funds are invested on private owned venture capital funds in technological fields which are consistent with the S&T policy of governments. As a manger from a public guidance fund management company mentioned:

> Public guidance funds define the domains, the industry and the projects of investment. For example, your fund has investment from public guidance funds aiming to develop biomedicine, you need to invest you money on biomedicine. Another example is that your fund received money from public guidance funds in Zhongguancun area, and then the percentage of investment of this fund on Zhongguancun cannot be less than 50 per cent (Interviewee 11).

By investing public guidance funds, public financial capital can be operated by experts in the field of venture capital and invested with market-orientation in this way. It can facilitate the efficiency on utilization of public money and help to leverage the private capital. There are several Tuspark Incubator-owned funds have the investments from public guidance funds, which let Tuspark Incubator help government to achieve the policy goals as well as obtaining profits. And now more financial support from government is delivered by ways of public guidance funds.

Although all the state-level TBIs in China are required to establish self-owned funds to support the development of NTBFs, the further subdivision of funds based on lifecycle of NTBFs enables Tuspark Incubator to have higher efficiency on new firms nurturing rather than other TBIs. Tuspark Incubator can provide appropriate financial support to NTBFs with various specific demands in different stages of the development lifecycle. The incubator can also gain financial profits as well as achieve the social objectives of government at the same time. In short, investing on different stages of the development lifecycle is one of the bedrocks for Tuspark Incubator to upgrade to a "hybrid incubator".

4.1.3 Concentration on promising new technology-based firms. Third is concentration on promising NTBFs. This is similar to the 'picking-the-winners' approach (Bergek and Norrman, 2008) for NTBFs selection criteria of TBIs. Bergek and Norrman (2008) distinguished two basic approaches, 'picking-the-winners' and 'survival-of-the-fittest' to describe the screening process of TBIs. They argued that incubator managers will attempt to ex ante identify several potentially successful infant firms in the 'picking-the-winners' approach. While In the 'survival-of-the-fittest' approach, less rigid selection criteria are applied. Larger number of NTBFs can be incubated first, and then winners and losers are identified relying on market selection. The selection criteria of Tuspark Incubator in general follows the tactic of "survival for the fittest". As a director mentioned:

> Our incubator does not set very specific criteria for start-ups. But there may be some invisible criteria. Unlike some other public TBIs, rental fees here are not free. And the price of rental fees is also higher than those public peers whose rental fees are not free in general. This means that the start-ups who started their business in Tuspatk Incubator need to be more innovative and have the capabilities to gain profits in the future to afford the rental fees (Interviewees 1).

And the manager of incubator also supports this viewpoint:

> We filter the fittest to survival by using rental fees. If a firm cannot afford our rental fees, it will leave by itself (Interviewee 4).

By the 'survival-of-the-fittest' approach, Tuspark Incubator can nurture more NTBFs with larger number of job creations to satisfy demand of local government. From 2006, Tuspark Incubator began to launch the "Diamond Project" to concentrate on providing the highest quality services for nurturing picking-the-winners. As one of customer service specialist of Tuspark Incubator introduced:

> TusPark started the "Diamond Project" to create high-tech companies with world-class technologies and industry leading positions. The project picked future "diamond companies" from TusPark, and integrated resources from universities, companies, governments from all over the world, supporting and helping them with capital, technology, talents and industry chains (Interviewee 6).

Based on further subdivision inside the incubator according to different selection approaches, firms incubated in Tuspark Incubator for a period with good potential are evaluated and selected by a group of experts. These experts are from relevant fields such as venture capital, business management and technology, etc. The incubator will also have equity investment on these selected promising NTBFs, named "diamond companies", with ultimate goals of nurturing them to be listed on stock market or merged by famous firms. The investment return of these "diamond companies" will be one of the core profit sources of Tuspark Incubator as these for-profit TBIs. Up till now, the project has selected 5 batches of 36 diamond companies, among which 7 have gone public (at list on stock market), 4 have been merged, and several others have started or finished share reform[6].

4.2 Intermediary platform

Another key factor for upgrade to hybrid incubator is "intermediary platform", which provides networking opportunities for tenant NTBFs (Figure 2). In all, 81 statements from the interviews (35 per cent) related to the intermediary platform are coded. Three sub-dimensions under this factor are distinguished, i.e. intermediary platform for external service firms, venture capitals and public institutions.

4.2.1 Platform linking the service firms. Tuspark Incubator provides higher quality and specialized services by building intermediary platform to help its incubating NTBFs accessing to external parties providing services that Tuspark cannot provide. Tuspark Incubator at the early stage of its establishment, similar to most Chinese public non-profit TBIs, followed a closed operation mode with the logic that TBIs attempted to directly provide services to NTBFs. This mode requires TBIs to cover all-around services and capabilities which will result in high costs and resource dispersion. Moreover, due to the lack of professionals and effective management teams, TBIs usually fail to provide high-quality business support for their incubating firms.

With the increasingly complex and specific demands NTBFs require, Tuspark Incubator can no longer satisfy these diversified needs following the closed operation model, and thus began to change to a more open model. TSP where Tuspark Incubator located in, gradually

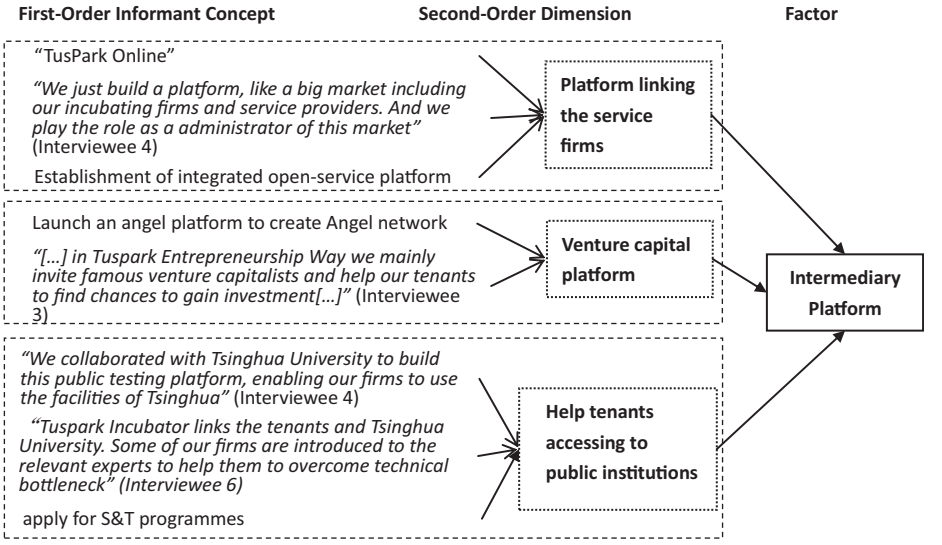

Figure 2.
Categorical analysis for upgrade elements: Intermediary platform

introduces specialized service companies, comprising consulting, staffing and legal service etc., to settle down (Motohashi, 2013). Tuspark Incubator also simultaneously built platforms to help its tenant NTBFs accessing to more specialized as well as higher quality services internal and external TSP. Based on the platform linking the specialized service firm, Tuspark Incubator also set the rules and screening the third-party service providers to control the service quality and satisfy the NTBFs. As an incubator manager said:

> We just build a platform, like a big market including our incubating firms and service providers. And we play the role as an administrator of this market (Interviewee 4).

Up till now, Tuspark Incubator has created an integrated open service platform including several sub-platforms for serving its incubating NTBFs. For example, one of the sub-platforms, "SaaS" (software-as-a-service) platform named "TusPark Online" offers comprehensive one-stop value-added services such as industry and transaction information online for innovative high-tech companies, as well as helping NTBFs to access to and utilize resources and related technologies for their growth and development. Tuspark Incubator can also better assist its customers and improve its work through this online platform, where users can exchange knowledge and place their problems and demands. Another example is the human resource platform collaborated with famous head-hunting companies. Through this way, incubating start-ups can publish their recruitment information to public and recruit demanded talents with the help of Tuspark Incubator. This also enhances the success chances of these start-ups in the competition on talents.

By building service platform, Tuspark Incubator has no need to directly provide some of the business support but outsource them to more specialized service providers alternatively. Incubating NTBFs can find the fittest services like market consulting, legal aiding and accounting, etc. By this way Tuspark Incubator lowered its cost and improved its resource allocation. Chinese government defines TBIs as a key element of national innovation system connecting the various actors in the innovation system with NTBFs. As mentioned before, Tuspark Incubator established a service platform for high-tech innovation enterprises with

Haidian government in 2005. Thus, Tuspark Incubator keeps the social benefits when it was non-for-profit that the using fee of these intermediary platforms is entirely free for its incubating NTBFs:

> To improve the development of our incubating firms, we built several platforms and created an evaluation body. There are no service fees for our tenants in principle (Interviewee 3).

4.2.2 Venture capital platform. As mentioned before, to help small NTBFs overcome the financial constraints, TusPark has established diverse investments and finance service systems. However, self-owned funds of the incubator are insufficient to satisfy the capital demands of incubating NTBFs, especially the firms which have grown up (Roberts, 1991). Thus, apart from the self-owned funds of Tuspark Incubator, it also created an intermediary platform to leverage the social venture capital for the incubating firms. For example, an angel platform was launched at 2011, aiming to provide more external angel investments for support the NTBFs at infant stage. Due to the high level of uncertainty and risk of seed stage NTBFs, investors, even angels are not willing to invest on such firms (Roberts, 1991). One way to solve this problem is to reduce the information asymmetry between investors and firms. Thus, Tuspark Incubator gathers famous angel investors and investment institutions. With the help of a professional investment and service team, Tuspark Incubator provides professional and scientific investment services for angel funds and investors on the platform, solving their problems on incubating firms and reducing the information asymmetry effectively.

The aforementioned activity "Tuspark Entrepreneurship Way" is another platform created to introduce external venture capital which can match the specific needs for different NTBFs. More specifically, TusPark Entrepreneurship Way aims at collecting and screening incubating NTBFs from Tuspark Incubator, connecting these elite innovative firms with external investors that complements the incubator's own investment funds:

> This platform completes the financial investment function of the incubation, creating success firms with integrated resources (Interviewee 5).

4.2.3 Platform accessing to public institutions. Another sub-dimension is to help tenants accessing to public institutions, mainly including public research institutions and governments. In the context of China, the linkage between public research institutions such as state-sponsored universities or colleges, and intermediary institutions plays a more significant role in innovation system (Zeng *et al.*, 2010). Due to the relationship with Tsinghua University, Tuspark Incubator plays as a platform to transfer research resources from the university to incubating firms. Not only can the specialized facilities of Tsinghua University be used by tenant enterprises through public testing platform but also the human resources like students and faculties can be connected as well. Relying on Tsinghua University, Tuspark Incubator can assist its start-ups to access to research facilities for further research and faculties for technical and business consulting. The incubator could also provide talent sources from Tsinghua University as well.

Another platform for the incubating NTBFs is to help them accessing with the governments, even though it is difficult for small Chinese NTBFs to get involved in governmental S&T programs. Being backed up by the Tsinghua University brand and the connection between Tuspark Incubator and government, tenant NTBFs can apply for S&T programs easier:

> As you know in China the government is very powerful. It is different from the West. The government has a lot of money and has a lot of project and if you are a company and you have good relationship with the government you will get a lot of chance (Interviewee 1).

By establishing intermediary platform, Tuspark Incubator outsources most of the business support activities but it supervises and controls the quality of the business support provided by external organizations. Simultaneously Tuspark Incubator reduces the costs and adopts proactive approaches which will be elaborated below.

4.3 Proactive approach

Abetti's study (2004) on TBIs in the Helsinki region shows that proactive approaches used by government, including creation of a learning environment and establishment of seeding funds, enable new high-tech agglomerations of incubators to be more successfully operated rather than reactive to perceived market failures such as subsidies and investments in deliberated "strategic" industries. The proactive approach does represent a method for accelerating economic growth and entrepreneurship (Abetti, 2004). Although this proactive approach is discussed from the government's perspective, Tuspark Incubator's activities are in line with this approach (Figure 3).

4.3.1 Innovation and entrepreneurship funds. A total of 104 (45 per cent) statements are coded related to proactive approach, in which 73 codified statements are about the second-order dimension, innovation and entrepreneurship funds, in Tuspark Incubator. A large part of these codified statements relevant to innovation and entrepreneurship funds are overlapping with those statements about financial investments in incubation subdivision. As mentioned before, Tuspark Incubator confirmed the development mode "incubation + venture capital" in 2001. Venture capital investment now is the most important profit source to make Tuspark Incubator self-sustainable. Apart from profit through investment by these funds, Tuspark Incubator can accomplish social objectives of the local government by integrating public guidance funds in its own funds. For example, Tuspark Incubator now has several special entrepreneurship funds on the basis of public financial capital to invest on firms in the specialized nanotechnology incubator. Such funds are consistent with S&T policy of governments, which can help government to achieve the policy goals.

4.3.2 Creation of learning and entrepreneurship environment. Another second-order dimension of this factor is the creation of a learning and entrepreneurship milieu. Abetti (2004) argues that as a part of regional innovation system, TBIs need to consider knowledge as the most fundamental resource, and learning is regarded as the most predominant

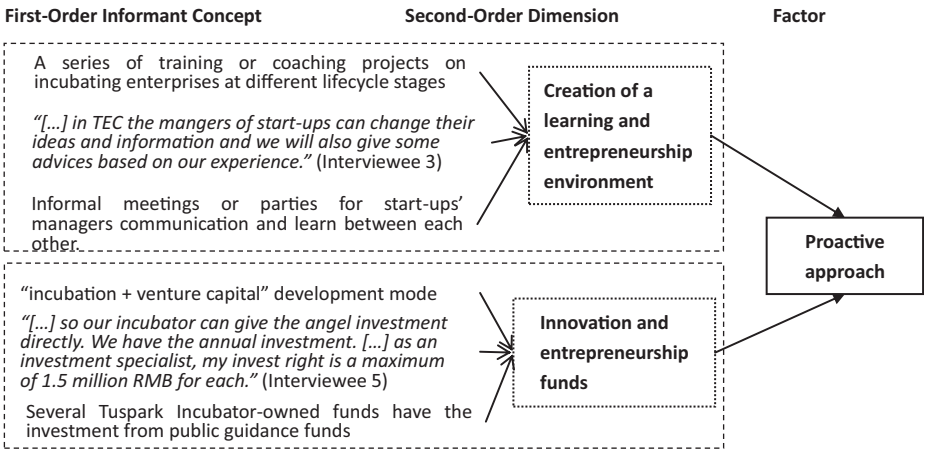

Figure 3.
Categorical analysis for upgrade elements: Proactive approach

interactive social process. Such social process cannot be built effectively through market mechanisms or by selecting certain industries. Thus, Abetti (2004) argue a learning environment as such that all participants in a regional innovation system can thrive need to be fostered for both codified and tacit knowledge dissemination and transfer.

The ways to nurture such milieus can be both formal and informal. An example of formal ways could be the entrepreneurship courses collaborating with Tsinghua University to encourage the students for business creation with training on relevant business skills:

> [...] we will do more on the field of education on nurturing entrepreneurship, including basic skills training of entrepreneurship, creation of new business and distinguish on business model (Interviewee 3).

During the interviews, employees from Tuspark Incubator introduced two courses set with Tsinghua University, "Starting a New Business" and "Entrepreneurial Opportunity Recognition and Business Plan", for innovation and entrepreneurship milieus fostering.

Due to the NTBFs founders' lack of business skills (Bollingtoft and Ulhoi, 2005), Tuspark Incubator organizes a series of training or coaching projects on incubating enterprises at different development stages to enable them to explore and exploit resource for successful business. A typical example is "TUSPARK Entrepreneurs Training Camp" in which experienced entrepreneurship tutors and mentors give lectures and consultations to help NTBFs founders to solve their difficulties during the firms' operation. Another training activity for incubating NTBFs is the "TusPark Entrepreneurship Salon":

> TusPark Entrepreneurship Salon is a training activity, covering all kinds of problems firms may encounter during their development (Interviewee 5).

Other formal activities for interaction between the NTBFs are also held. For example, Tsinghua Entrepreneurship Club (TEC) provides opportunities for NTBFs founders changing their ideas and information as well as gain valuable advices from each other:

> In TEC the mangers of start-ups can change their ideas and information and we will also give some advices based on our experience. In general, we hold various activities for different specific needs of our incubating firms (Interviewee 3).

Informal ways can be activities like meetings or parties organized by the incubator for communication and tacit knowledge sharing between NTBFs' managers. By learning and entrepreneurship milieus cultivation, Tuspark Incubator facilitate its incubating NTBFs to grow with full potential to be successful firms which are benefit to both social objectives of government and for-profit goals of the incubator itself.

5. Discussion

According to our case study, Tuspark Incubator gradually change the main profit source from public subsidies to financial returns of equity investment on incubating firms. Practicing like a venture capital, Tuspark Incubator adds for-profit features and is encouraged to operate through more market-orientation ways for seeking more financial returns.

To retain non-for-profit social functions, incubation subdivision is used. The logic of subdivision structure is similar to the study of Aaboen's (2009), which suggest to create multiple incubation processes with both non-for-profit and for-profit incubators features. First main incubation subdivision is the classification of different types of financial funds according to distinct demands of NTBFs at different lifecycle stages. This subdivision on financial funds complements the under-developed capital market in China (Puffer *et al.*, 2010).

Through subdivision on financial funds, Tuspark Incubator can both invest for fast financial return and nurture technology or NTBFs at early-stage with higher risks and uncertainties. In addition, subdivision on financial funds enables Tuspark Incubator to leverage public guidance funds for some incubation fields satisfying governments' demands. Second type of incubation subdivision is classification by industrial sectors. By building several specialized incubators, Tuspark Incubator can seek profits from matured industrial sectors, and incubates firms in frontier technology field with high failure rate to satisfy the policy objectives at the same time. Specialized sub-incubators make management team of Tuspark Incubator to provide more accurate services. Apart from subdivided by industrial sectors, Tuspark Incubator also subdivides its tenant firms by development potential. Tuspark Incubator selects several promising firms to concentrate resources on and to ensure their success. Return of equity investment on these promising firms can, to some extent, ensure the profitable self-sustainability of Tuspark Incubator.

Building intermediary platforms is another key factor for Tuspark Incubator to operate hybrid functions. Tuspark Incubator establish intermediary platforms for its incubating NTBFs to access to external resource. Unlike findings of several existing studies that value-added services are one of the main profit sources of TBIs (Bruneel *et al.*, 2012), service fees in Tuspark are almost free, which can be regarded as part of social welfare providing. Intermediary platforms can also connect NTBFs with external specialized service agencies. Non-for-profit TBIs usually lack of specialized capabilities on providing incubation services during the upgrading process to hybrid incubators. Thus, it might be better to outsource a service which is in line with the suggestion of Carayannis and von Zedtwitz (2005). The practice of Tuspark Incubator suggests that it is important for incubators to create evaluation and supervision systems on external agencies when building intermediary platforms. Apart from accessing to external service, intermediary platforms are also useful to help firms to connect with government. This is the role of innovation intermediaries to bridge NTBFs to public-sector resources in emerging economies (Dutt *et al.*, 2016). In addition, Tuspark Incubator can save its resource from providing own business services and devote to establish own funds, which is a key way for Tuspark Incubator to maintain the hybrid functions.

Based on incubation subdivision and intermediary platforms, Tuspark Incubator fosters an entrepreneurial environment and facilitates incubating firms to establish networks. This more proactive approach on incubation can enhance the success possibilities of NTBFs, as these incubating firms can gain more learning opportunities and improve their firm-level business capabilities (Abetti, 2004; Bruneel *et al.*, 2012; Carayannis and von Zedtwitz, 2005).

6. Conclusion

This research is a pioneering study on the key factors and specific ways for the upgrade of government-sponsored non-for-profit TBIs in China to hybrid incubators with both for-profit and non-for-profit features. The research finding shows that incubator-owned funds are the main profit sources of Tuspark Incubator. Business and social goals are aligned in one incubator model of Tuspark Incubator on the basis of incubation subdivision. Tuspark Incubator builds intermediary platforms for providing specialized business support and high-quality networking. Tuspark Incubator also emphasizes on fostering entrepreneurship environment by coaching, training and providing courses, etc. to help entrepreneurs to gain business skills and capabilities.

6.1 Implication

Although Tuspark Incubator is comparatively unique, the upgrade experiences of it from not-profit to a hybrid incubator can still bring implications to both managers of public TBIs and policy makers from emerging economies.

For the incubators' managers, especially the mangers of generic TBIs, incubation subdivision could be one solution to operate for-profit and non-for-profit processes at the same time. TBIs can provide more specific needs for different incubating start-ups based on this incubation subdivision. Another important implication is that public TBIs need to create more open intermediary service platforms which leverage the full potential of the actors in innovation system to enable TBIs to embed themselves into the system. To enhance the successful rate on NTBFs incubation, an appropriate learning climate and entrepreneurship environment is required to be nurtured within incubator. The main profit source of Tuspark Incubator is self-owned funds, which can be the next implication for TBIs' managers. By establishing the funds, not only can incubating firms receive fast investment for survival but also TBIs can leverage public resources as well, especially with the increasing amount of public guidance funds since 2007. For policy makers, creating a good milieu for incubation on technology-based start-ups is the most crucial. As Abetti (2004) argued that proactive approaches including learning environment creation and seeding funds establishment is preferable compared with a reactive approach that provides subsidies to deliberated "strategic" industries after perceiving market failures. Thus, policy makers need to adopt more proactive approaches. The emerging public guidance funds is a benign tendency for the NTBF incubation environment building in China.

6.2 Limitation and further studies

There are also several limitations of this study, which provides further research directions. First limitation is related to the selected case. Tuspark Incubator belonging to TSP has tight ties with Tsinghua University which possesses rich resources on science and technology. Although almost all the public TBIs claim that they have collaborations with regional famous universities, neither quality nor efficiency of the resources they gain from these universities can compare with the resources Tuspark Incubator obtains from Tsinghua University. In addition, the Tsinghua alumni network is powerful under strong *guanxi* culture in China. Second limitation is that external environment of Tuspark Incubator is comparatively unique. Beijing, the capital city of China, is more developed than most other regions in China. The innovation intermediary service agents are developed which can support the intermediary platform for outsourcing the business support services of Tuspark Incubator. The government intervention in Beijing is less, and the capital market is developed as well which can enhance the upgrade of Tuspark Incubator. Thus, the research objects of further studies can be expanded to other state-level TBIs in Beijing or BTIs from other regions of China. Multi-case or comparative case studies can be carried out to further the research findings.

Notes

1. Interviewee 5: From the 2011, the government reduced their investment on incubators, I mean, the direct subsidies. Because they (the policy makers) found that incubators they gave money to cannot reach the goals, they set at the beginning.
2. Interviewee 3: *One of the assessment criteria of state-level TBIs is to create own innovation and entrepreneurship funds.*

3. Torch Statistical Yearbook 2013. *China Statistics Press* (in Chinese).
4. From Interviewee 1: *The incubator doesn't profit all over the world. But our incubator is setup as a venture capital so we can profit by the incubator.*

   And from Interviewee 2: *The main way incubators can gain money I think is to depend on equity investment on incubated firms, and our incubator possesses our own funds for such investment and can gain considerable income from it. Our investment experience is also sophisticated in China.*
5. Firm needs to reach at least one of two criteria, which the firm founder is from parent universities or the core competitiveness relies on research achievements from parent universities, can be defined as a university spin-off (Steffensen *et al.*, 2000).
6. Exclusive data from Tuspark Incubator (in Chinese).

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